SECTION 03310

CAST-IN-PLACE CONCRETE

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LANL MASTER CONSTRUCTION SPECIFICATION

TO BE USED WITH SECTIONS 03100 AND 03200

This section applies to structural concrete for buildings that are designed in accordance with ACI 318, non-nuclear facilities classified as Performance Category (PC) 1 or 2 facilities. This section does not apply to nuclear facilities.

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Structural POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete.

B. Control, and expansion and contraction joint devices associated with concrete work.

1.2 RELATED SECTIONS

A. Section 03100 - Concrete Formwork

B. Section 03200 - Concrete Reinforcement.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01330, Submittal Procedures:

B. Concrete design mixes.

1. Submit separate mix design for:

a. Each concrete strength.

b. Each range of air content.

c. Each nominal maximum aggregate size.

d. Concrete to be pumped.

e. Concrete with identifiable admixtures.

2. Include the following information with each design:
    a. Quantity of water.
    b. Type, brand, certification, and quantity of cement.
    c. Source, certification, and quantity of each nominal maximum size of aggregate.
    d. Type, brand, sources, certification and quantity of admixtures, if used.
    e. Type, source, certification and quantity of fly ash, if used.
    f. Water/cement ratio.
    g. Air-content.
    h. Slump.
    i. Strength test record, in accordance with ACI 301.

C. Batch Tickets

1. Submit 2 legible copies of the batch ticket for each load of concrete to the LANL Construction Inspector.
2. Conform to the requirements for batch tickets in accordance with ASTM C94. Include the following information:
    a. Name of ready-mix batch plant.
    b. Serial number of ticket.
    c. Date.
    d. Truck number.
    e. Name of purchaser.
    f. Specific designation of job (name and location).
    g. Specific class or designation of the concrete in conformance with that employed in job specifications.
    h. Amount of concrete in cubic yards (or cubic meters).
    i. Time loaded or of first mixing of cement and aggregate.
    j. Water added by receiver of concrete and his initials.
    k. Reading of revolution counter at the first addition of water.
    l. Type and brand, and amount of cement.
    m. Type and brand, and amount of admixtures.
    n. Information necessary to calculate the total mixing water added by the producer. Total mixing water includes free water on the aggregates, water, and ice batched at the plant, and water added by the truck operator from the mixer tank.
    o. Maximum size of aggregate.
    p. Weights of fine and coarse aggregate.
    q. Ingredients certified as being previously approved.
    r. Signature of initials of ready-mix representative.

3. Record on each, the location where placed in structure and time of placements.

D. Catalog Data: Provide data on joint devices, attachment accessories, and admixtures.

E. Test reports of concrete field testing per PART 3, Field Quality Control.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301, 318, and 347.

B. Acquire cement from same source for all work.

C. Acquire aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I or Type II.

B. Fine and Coarse Aggregates: Conform to ASTM C33.

C. Water: Potable water that is clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Air Entrainment: Conform to ASTM C260.

B. Chemical: Conform to ASTM C494.

C. [Fly Ash: Conform to ASTM C618, Type F].

2.3 ACCESSORIES

A. Bonding Agent: Polymer resin emulsion.

B. Vapor Barrier: 6 mil clear polyethylene film, of type recommended for below grade application.

C. [Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1751; asphalt impregnated fiberboard or felt, 1/4 in. thick.

B. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 in., and ribbed steel spikes with tongue to fit top screed edge.

C. [Expansion Joint Devices: ASTM B221, extruded aluminum; resilient elastomeric filler strip with a Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum cover plate, of longest manufactured length at each location, flush mounted.]

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301, proportioning on the basis of previous field experience or trail mixtures method, for f_{cr} = the larger of:

$f_{cr} \geq f'_c + 1.34s$, or

$f_{cr} \geq f'_c + 2.33s - 500$, where:

f_{cr} = required average compressive strength of concrete mix design, psi

f'_c = specified design compressive strength of concrete, psi

s = standard deviation, psi

If a suitable record of tests is not available to establish a standard deviation, use the following:

$f_{cr} \geq f'_c + n$, where:

n = additional required strength, psi, for a specified f'_c

n = 1000 psi for f'_c = less than 3000 psi.

n = 1200 psi for f'_c = 3000 to 5000 psi.

n = 1400 psi for f'_c = over 5000 psi.

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The Structural Engineer shall specify the required 28 day concrete strength f'_c in accordance with Structural Standards.
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C. Provide concrete meeting the following criteria:

1. Exterior concrete exposed to freezing and thawing.
   a. Compressive strength, f'_c: [4,000 psi @ 28 days].
   b. Maximum nominal aggregate size: [0.75 in.]
   c. Maximum water / cement ratio: [0.44]
   d. Slump: [3 in. plus or minus 1 in. tolerance].
   e. Air content: [4 to 6] percent.

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Caution - 5000 psi concrete is prone to hairline cracking.
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2. Exterior concrete exposed to freezing and thawing.
   a. Compressive strength, f 'c : [5000 psi, at 28 days].
   b. Maximum nominal aggregate size: [0.75 inch].
   c. Maximum water/cement ration: 0.34.
   d. Slump: [3 inches plus or minus 1 inch tolerance].
   e. Air Content: [4 to 6] percent.

3. Interior concrete not exposed to freezing and thawing.
    a. Compressive strength, f'_c: [4,000 psi @ 28 days].
    b. Maximum nominal aggregate size: [0.75 in.]
    c. Maximum water/cement ratio: [0.44]
    d. Slump: [3 in. plus or minus 1 in. tolerance].
    e. Air content: [2 to 4] percent.
4. Interior concrete not requiring air entraining agent.
    a. Compressive strength, f'_c: [5000 psi, @ 28 days.]
    b. Maximum nominal aggregate size: [0.75 in.]
    c. Maximum water/cement ratio: [0.34]
    d. Slump: [3 in. plus or minus 1 in. tolerance]
    e. Air Content: [0 to 2] percent.

D. Use accelerating admixtures in cold weather only when approved by the LANL Construction Inspector. Use of admixtures will not relax cold weather placement requirements.

E. Do not use calcium chloride as an admixture.

F. Use set retarding admixtures during hot weather only when approved by the LANL Construction Inspector.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. [In locations where new concrete is to be dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.]

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify the LANL Construction Inspector a minimum of 24 hours prior to commencement of concreting operations.

C. Ensure that reinforcement, inserts, embedded parts, formed joint fillers, joint devices, and formwork are not disturbed during concrete placement.

D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 in. and seal watertight by sealant applied between overlapping edges and ends or taping edges and ends.

E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 in. and seal watertight.

F. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

G. Separate slabs on grade from vertical surfaces with 1/4 in. thick joint filler.

H. Extend joint filler from bottom of slab to within 1/4 in. of finished slab surface.

I. Install joint devices in accordance with manufacturer's instructions.

J. Place concrete continuously between predetermined expansion, control, and construction joints.

K. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.4 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, remove deleterious material. Broom and vacuum exposed surface clean.

B. Place required reinforcing and other items to be cast in.

C. Screed toppings level, maintaining surface flatness of maximum 1/4 in. in 10 ft.

3.5 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Wood float surfaces which are to receive tile with full bed setting system.

D. Steel trowel surfaces which are to receive carpeting, resilient flooring or thin set tile.

E. Steel trowel surfaces which are scheduled to be exposed.

F. Provide broom finish on exterior sidewalks and paving.

G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 in. per foot minimum.

3.6 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for complete hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 308.

3.7 FIELD QUALITY CONTROL

A. Provide a certified independent testing agency to perform field testing in accordance with ACI 301.

B. Submit proposed mix design of each class of concrete to the LANL Construction Inspector for approval prior to commencement of work.

C. Inform the LANL Construction Inspector 48 hours in advance of field testing to allow for witnessing of testing.

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The Structural Engineer shall determine the frequency and type of field and laboratory testing. The batch plant that supplies concrete to LANL currently produces concrete with a standard deviation of 700 psi for 4000 psi air entrained concrete.

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D. The Testing Agency shall perform the following tests and collect strength cylinders on one batch in every 50 cu. yds. of concrete placed or once a day when less than 50 cu. yds. is placed.

1. Record temperature of concrete in accordance with ASTM C1064.
2. Perform slump test in accordance with ASTM C143.
3. Perform air content test in accordance with ASTM C231, pressure method.
4. Take 4 concrete strength test cylinders in accordance with ASTM C31.

E. The Testing Agency shall test the strength test cylinders in accordance with ASTM C39.

3.8 CONCRETE ACCEPTANCE CRITERIA

A. Fresh Concrete

1. Temperature - Less than 90 degrees F.
2. Slump - per Section 2.5.
3. Air content - per Section 2.5.
4. Drum revolution counter - 100 to 300 revolutions within 1-1/2 hours of initial mixing.

B. Strength

1. Concrete strength is satisfactory if the average of all sets of 3 consecutive strength test results equal or exceed the specified 28 day strength f'_c and no individual strength test result falls below the specified 28 day strength f'_c by more than 500 psi.

C. Appearance

1. Free from honeycombs and embedded debris.

D. Construction requirements

1. Conforming to required lines, details, dimensions and tolerances specified for construction.

3.9 DEFECTIVE CONCRETE

A. Defective concrete is concrete not conforming to acceptance criteria in Section 3.9.

B. Do not accept or place defective concrete that is not in conformance with acceptance criteria. Return the fresh concrete to the supplier.

C. Replace defective concrete not meeting strength criteria, at Contractor's expense. The Contractor may, at its expense, evaluate the concrete's in-place strength by testing 3 core samples for each strength test where LANL cured cylinders where more than 500 psi below f'_c in accordance with ACI 301 and ASTM C42. Fill holes in accordance with ACI 301.

D. Replace defective concrete not meeting appearance criteria, at Contractor's expense. The Contract Administrator may allow repair of defective concrete at Contractor's expense.

E. Replace concrete not in conformance with details, tolerances, and other construction requirements at Contractor's expense.

END OF SECTION

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Do not delete the following reference information:
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FOR LANL USE ONLY

This project specification is based on LANL Master Construction Specification Rev. 3, dated August 30, 2002.